

**T 168 Sampling Bituminous Paving Mixtures**

1. Which of the following containers may be used for samples of open-graded Hot Mix Asphalt?
  - a. Stainless steel bowls.
  - b. Cardboard boxes.
  - c. Wide-mouth plastic container with screw cap; protect sample from freezing.
  - d. a & b
  - e. All of the above.
2. Which of the following statements is **incorrect**?
  - a. When using an attached sampling device to obtain samples of HMA, one must pass the container twice through the material perpendicularly without overfilling.
  - b. Samples of dense-graded mixtures may be placed in cardboard boxes or other agency approved containers.
  - c. When sampling from the roadway prior to compaction using the plate method, it is always required to use the plate and cookie cutter sampling device.
  - d. a & b
  - e. None of the above.
3. Which of the following statements is true?
  - a. HMA sample size depends on the test methods specified by the agency for acceptance. The agency requirement therefore governs required sample size.
  - b. Samples used for acceptance tests must be selected at random. Samples may be obtained by the purchaser or authorized representative.
  - c. When using mechanical sampling devices that are manually operated, no special caution is required regarding consistent speed in passing the device through the material.
  - d. a & b
  - e. All of the above.

**T 328 Reducing Samples of HMA to Testing Size**

4. According to this FOP, use of Method A (Mechanical Splitter) or Method C (Riffle Splitter) is preferred...
  - a. when reducing samples to a size appropriate for individual test procedures.
  - b. because it allows rapid sample reduction while the sample is still warm enough to separate readily.
  - c. Never.
  - d. a & b
  - e. None of the above.

5. When reducing HMA samples to testing size by Method A (Mechanical Splitter)...
- a. HMA from opposite receptacles must be combined either to form the sample, or for further reduction to testing size.
  - b. surfaces that will be in contact with HMA must be heated to a temperature not exceeding 230°F prior to use.
  - c. use of the agency-approved release agent is not required.
  - d. a & b
  - e. None of the above.
6. Which of the following **does not** describe the Quartering Template used for the Method B procedure at time of use?
- a. The template is manufactured of metal that will withstand heat and use without deforming.
  - b. The template is formed in the shape of a cross having equal length sides at right angles to each other. Length and height of sides must exceed the diameter and thickness of the flattened cone of HMA.
  - c. The template is heated prior to use and may receive a light coating of approved release agent.
  - d. None of the above.
7. With the exception of miscellaneous tools such as trowels, spatulas, tapping knives, etc., the apparatus for which method(s) is not heated prior to use?
- a. Method A
  - b. Method B
  - c. Method C
  - d. a & b
  - e. None of the above. All reduction apparatus must be heated.

### **T 329 Moisture Content of Hot Mix Asphalt (HMA) by Oven Method**

8. When determining HMA moisture content by this FOP, the minimum sample mass is \_\_\_\_\_. Sample masses are determined to \_\_\_\_\_.
- a. 1000 grams - - 0.1 gram or 0.1% of sample mass whichever is greater.
  - b. 500 grams - - 0.1% of sample mass.
  - c. 1000 grams - - 0.1 gram.
  - d. None of the above.

9. According to this FOP, what constitutes constant mass?
- After initially drying for 90 minutes, constant mass has been achieved when further drying does not alter the mass by more than 0.01% after an additional 30 minutes of drying.
  - After initially drying for 45 minutes, constant mass has been achieved when further drying does not alter the mass by more than 0.01% after an additional 15 minutes of drying.
  - After initially drying for 90 minutes, constant mass has been achieved when further drying does not alter the mass by more than 0.05% after an additional 30 minutes of drying.
  - After initially drying for 45 minutes, constant mass has been achieved when further drying does not alter the mass by more than 0.05% after an additional 15 minutes of drying.
  - None of the above. Because this moisture determination is used for binder content correction, there can be no mass loss after the additional drying period.
10. Moisture content calculation (Choose the correct formula).

$$\text{Moisture Content} = \frac{M_i - M_f}{M_i} \times 100 \quad \text{or,} \quad \text{Moisture Content} = \frac{M_i - M_f}{M_f} \times 100$$

Known:

Agency reports binder content based on mass of dry aggregate  
 Mass of dry, clean container = 503.4 grams  
 Sample + container (initial moist condition) = 2768.4 grams  
 Sample + container (final dry condition) = 2764.2 grams

The reported moisture content is \_\_\_\_\_ percent.

- 0.19
- 0.18
- 0.2
- None of the above.

### **T 308 Determining the Asphalt Binder Content of Hot Mix Asphalt (HMA) by the Ignition Method**

11. According to this FOP, binder content is calculated as the difference between the initial mass of the HMA and the mass of the residual aggregate. The binder content is expressed as a percent of initial HMA mass only when the agency expresses binder content as a percent of initial HMA mass.
- True
  - False

12. According to this FOP, if the mixture is not sufficiently soft to separate with a spatula or trowel, place it in a large flat pan in an oven at \_\_\_\_\_ until soft enough.
- Mixing Temperature.
  - Compaction Temperature.
  - 325° F
  - None of the above.

13. Asphalt binder content correction factor ( $C_f$ ) calculation:

$$C_f = \left[ \frac{M_i - M_f}{M_i} \right] \times 100$$

Known:

	Sample 1	Sample 2
Mass of empty basket assembly	= 3070.6 grams	3079.1 grams
Sample + basket before ignition	= 5210.7 grams	5204.4 grams
Sample + basket after ignition	= 5081.5 grams	5079.0 grams
JMF Design Binder Content	= 4.90 percent	

Based on the two determinations, the asphalt binder content correction factor would be \_\_\_\_\_ percent. Is this factor acceptable for use at a set point temperature of 1000°F?

- 1.07 - - No
- 1.44 - - Yes
- 1.44 - - No
- 1.07 - - Yes
- None of the above.

## T 209 Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt

14. Which method always requires use of a temperature correction factor?
- Bowl Method
  - Flask Method
  - Both methods
  - Neither method
15. According to this FOP, the mass of the bowl filled with water at 77±0.9°F is determined for use as “D” for the  $G_{mm}$  calculation.
- True
  - False

16. Rice Calculation

$$G_{mm} = \left[ \frac{A}{A + D - E} \right]$$

Known:

	Sample 1	Sample 2
Dry, Cooled Sample Mass (A)	= 2186.4 grams	2105.1 grams
Mass of Flask + Water (D)	= 7681.9 grams	7681.9 grams
Mass of Flask + Water + Sample (E)	= 8993.0 grams	8947.1 grams

Based on the information provided what is the average  $G_{mm}$ ? Is the test valid (Yes/No)?

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If the test is not valid, why is this the case?

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17. Describe the procedure used to check for uncoated porous aggregates.

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**T 166 Bulk Specific Gravity of Compacted Hot Mix Asphalt Using Saturated Surface-Dry Specimens**

**T275 Bulk Specific Gravity of Compacted Hot Mix Asphalt Using Paraffin-Coated Specimens**

18. According to this FOP, for Methods “D” and “E” (Coated Specimens) when is dry mass determined; for methods “A” and “B” (SSD Specimens)?
- Dry mass is always determined first regardless of test method.
  - Dry mass is determined last for methods “D” and “E.” It is always determined first for methods “A” and “B.”
  - Dry mass should be determined last for all test methods because doing so expedites the process (shortens the time required for completion).
  - Dry mass is determined first for methods “D” and “E.” Dry mass may be determined either first or last for methods “A” and “B.”
  - None of the above. The sequence of mass determinations may be in any convenient order regardless of test method.
19. Under which conditions is Method B (Volumeter) **not permitted**.
- When the specimen has less than two (2) percent absorption by volume.
  - When the specimen has more than two (2) percent absorption by mass.
  - When the specimen has air voids exceeding six (6) percent.
  - All of the above.
  - None of the above.

20. Bulk Specific Gravity and Absorption Calculations (Suspension Method):

$$G_{mb} = \frac{A}{B - C}$$

$$\text{Absorption} = \frac{B - A}{B - C} \times 100$$

Known

Dry Specimen Mass (A)	=	4671.1 grams
SSD Specimen Mass (B)	=	4710.0 grams
Submerged Specimen Weight (C)	=	2703.5 grams

Based on the information provided, the  $G_{mb}$  is \_\_\_\_\_. The procedure represented is \_\_\_\_\_ (A, B, D or E). Is this a valid test method for the specimen data provided (Yes/No)?

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**T40 Sampling Bituminous Materials**

21. According to this FOP, which kind(s) of material must be protected from freezing?
- a. Only material sampled when in the solid or semi-solid state.
  - b. Performance Graded (PG) Binders sampled from the HMA plant, because freezing may cause changes that alter the binder grade.
  - c. Cutbacks and HMA binders.
  - d. Emulsions and cutbacks.
  - e. None of the above.
22. What special precaution(s) must be taken when sampling emulsified asphalt?
- a. Emulsions must be sampled prior to dilution unless the material is obtained directly from the spray bar, in which case the binder is considered to be representative of that used on the roadway.
  - b. No special precautions are required other than those concerning cleanliness of the container.
  - c. Emulsions may only be sampled from the delivery truck to avoid contamination that occurs when pumping into the distributor.
  - d. The sample container must be completely filled to avoid formation of a skin on the sample.
  - e. None of the above.

### T 30 Mechanical Analysis of Extracted Aggregate

Gradation Calculations:

Dry mass of sample, before washing: 1798.6 g

Dry mass of sample, after washing: 1660.1 g

Sieve Size (in.)	Mass Retained g	Ind. Percent Retained	Cumulative Mass Retained g	Cum. Percent Retained	Calc'd Percent Passing	Agg. Corr. Factor From T-308	Reported Percent Passing
3/4	0		0				
1/2	35.5		35.5			-1.9	
3/8	243.9		279.4			-2.3	
1/4	240.2		519.6			-1.1	
No. 4	273.5		793.1			-0.9	
No. 8	377.1		1170.2			0.7	
No. 30	209.9		1380.1			-3.3	
No. 50	124.2		1504.3			-1.8	
No. 100	88.7		1593.0			-1.1	
No. 200	34.4		1627.4			-0.7	
Pan	29.4		1656.8				

23. For the No. 100 sieve, the individual percent retained is \_\_\_\_\_. The calculated percent passing is \_\_\_\_\_. The final reported percent passing is \_\_\_\_\_. The sample is acceptable when evaluated for unexplained change in sample mass (True/False).

Based on the data presented, would corrections be required for all sieves (Yes/No)? \_\_\_\_\_

If corrections **are** required for all sieves, why is this the case? \_\_\_\_\_

24. When performing the annual evaluation of mechanical shakers for sieving efficiency, continue shaking for a sufficient period so that after completion, not more than 0.5% by mass (**based on individual mass retained on any given sieve**) passes during one minute of continuous hand sieving.

- a. True
- b. False



**T 312 Preparing and Determining the Density of HMA Specimens by Means of the Superpave Gyratory Compactor**

25. The angle of gyration may refer to either the internal or external angle. The pressure applied during compaction must be within a specified range.

The correct internal angle is \_\_\_\_\_; that of the external angle is \_\_\_\_\_; the pressure applied during compaction is \_\_\_\_\_.

- a.  $1.25 \pm 0.02^\circ$  - -  $1.16 \pm 0.02^\circ$  - -  $600 \pm 18$  Pa.
- b.  $1.16 \pm 0.02^\circ$  - -  $1.16 \pm 0.02^\circ$  - -  $600 \pm 16$  kPa.
- c.  $1.16 \pm 0.02^\circ$  - -  $1.25 \pm 0.02^\circ$  - -  $600 \pm 18$  Pa.
- d.  $1.16 \pm 0.02^\circ$  - -  $1.25 \pm 0.02^\circ$  - -  $600 \pm 16$  kPa.
- e. None of the above.

26. This FOP covers preparing gyratory-compacted specimens that may be used for field control of HMA production processes.

- a. True
- b. False

27. After filling the mold, leveling the HMA and installing the paper disc, what next must be done?

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**WAQTC TM 5 Reducing Samples of HMA to Testing Size**

28. According to WAQTC TM 5, when reducing large samples (samples over 75 lb), the sample is mixed \_\_\_\_\_ times using a heated trowel or spatula. After forming into a conical pile, the pile is flattened such that the ratio of diameter to height is \_\_\_\_\_.
- a. Three - - 3 to 6 : 1
  - b. Three - - 4 to 8 : 1
  - c. Four - - 3 to 6 : 1
  - d. Four - - 4 to 8 : 1
  - e. None of the above. For this method, the pile is not flattened.
29. According to WAQTC TM 5, for which method(s) of sample reduction is it **not permissible** to mix the sample by rolling using a heavy paper or other suitable material?
- a. Large samples (samples over 75 lb).
  - b. Method A (Loaf Method)
  - c. Method B (Quartering by Apex)
  - d. Method C (Quartering)
  - e. None of the above.
30. According to WAQTC TM 5, when is use of a mechanical splitter permitted or required?
- a. When reducing large samples (samples over 75 lb) to a more manageable size.
  - b. Use of a mechanical splitter is always preferred for reduction to testing size because it removes most of the “human error” or bias from the procedure.
  - c. Never.
  - d. Only when the other methods are deemed inappropriate by the agency.
  - e. None of the above.